

## CLAIMS

1. A process for forming a single-piece co-cured composite wing structure having a flying surface and at least one structural member, the process comprising:
  - situating a first flying surface composite material in alignment with a controlling  
5 surface of a first clamshell frame;
  - aligning a plurality of forms to the first clamshell frame, wherein a composite material is positioned between selective forms, and wherein selective forms are pressurizable;
  - situating a second flying surface composite material between the plurality of  
10 forms and a controlling surface of a second clamshell frame;
  - closing the first and second clamshell frames together; and
  - curing the composite material.
2. The process, as recited in claim 1, wherein the composite material positioned between selective forms creates a spar.
- 15 3. The apparatus, as recited in claim 2, wherein the spar is comprised of two substantially C-shaped composite sections.
4. The apparatus, as recited in claim 3, wherein the C-shaped sections are positioned in opposing orientations to form an I-beam.
5. The apparatus, as recited in claim 2, wherein the spar is sinusoidal shaped.
- 20 6. The process, as recited in claim 1, wherein the forms are a foam core surrounded by a membrane.
7. The process, as recited in claim 6, wherein membrane of the selective pressurizable forms are capable of receiving a positive pressure during a curing process.

8. The process, as recited in claim 6, wherein the foam core shrinks during a curing process.

9. The process, as recited in claim 6, wherein shape of the foam core controls the shaping of the composite material.

5           10. The process, as recited in claim 1, wherein the selective pressurizable forms compress the first flying surface and the second flying surface against the controlling surfaces of the clamshell frames.

11. The process, as recited in claim 1, wherein the selective pressurizable forms compress against adjacent forms.

10           12. The process, as recited in claim 1, wherein the first flying surface and the second flying surface are part of a single sheet of composite material.

13. The apparatus, as recited in claim 1, wherein the wing structure is at least one of an ailerons, a wing tip, a horizontal stabilizer, a vertical stabilizer, a flap, an elevators and a canard.

15           14. The process, as recited in claim 1, further comprising applying a layer of primer to the controlling surface of the first clamshell frame and to the controlling surface of the second clamshell frame.